Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

**Liver Enzyme Lab**

Ms. OK, Pre-AP Biology, 2014-2015

**Background Information:**

Liver and other living tissues contain the enzyme catalase. This enzyme breaks down hydrogen peroxide, which is a harmful waste product in cells. If we use liver or other tissue containing this enzyme, we can measure the effect of reducing the temperature on the efficiency of enzyme function. The reaction for the break-down of hydrogen peroxide (by catalase) into water and oxygen gas is given below.

2H2O2 🡪 2H2O + O2

**Your Hypothesis:**

If we reduce the temperature of the reaction involving the breakdown of hydrogen peroxide by catalase, then the rate of reaction (measured by the height of the oxygen bubble products produced) will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (higher or lower).

Explain your hypothesis based on what you know about the effect of lower temperatures on enzyme function:

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**Materials:**

|  |  |
| --- | --- |
| 3 Test tubes and rack Glass stirring rod  10-ml Graduated cylinder 2 beakers for water baths | Thermometer  Ruler  10 ml 3% Hydrogen peroxide solution Chicken liver |

**Procedure**

1) Measure 1 mL of hydrogen peroxide and pour into a small test tube. Take the temperature (room temperature) in degrees Celsius of the hydrogen peroxide and record. Place a small piece of liver (approximately one cm square), and measure the change in height of the bubbles produced in millimeters (mm0. Repeat this procedure two more times for a total of three trials.

2) Create a cold water bath with icde and water in a beaker. Place a tube with liver and a tube with 1 mL of hydrogen peroxide into the water bath for 3 minutes, and take the temperature of the water bath. Remove the liver and hydrogen peroxide tubes from the water bath and pour the hydrogen peroxide into the liver tube. Measure the change in height of the bubbles produced. Repeat this procedure two more times for a total of three trials.

**Methods Summary Chart:**

|  |  |
| --- | --- |
| Independent Variable |  |
| Dependent Variable |  |
| Method for Measuring Changes in the Dependent Variable |  |
| Control Group |  |
| Experimental Group |  |
| Constants (factors that stay the same between your control group and your experimental groups) |  |

**Data Tables (Individual Lab Group)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Trial** | **Temperature (in degrees Celsius)** | **Height of the Bubbles (in mm)** | **Class Average Height (in mm)** |
| Room Temp #1 |  |  |  |
| Room Temp #2 |  |  |
| Room Temp #3 |  |  |
| Cold #1 |  |  |  |
| Cold #2 |  |  |
| Cold #3 |  |  |

**Discussion / Conclusion:** In your discussion / conclusion paragraph, please include the following information.

1) State whether the class data supports or refutes the hypothesis.

\_\_\_\_\_/1

2) Explain how the class averages for the room temperature trials and the cold trials support or refute the hypothesis. You must identify the actual numerical values for the class averages in your explanation.

\_\_\_\_\_/2

3) Explain why the class data makes sense based on what you know about the effect of lower temperatures on the rate (speed) of reactions assisted by enzymes.

\_\_\_\_\_/2

4) Predict the effect of drastically increasing the temperature (past the optimum temperature for the enzymes) on the rate of reaction. Explain what you would expect to see in the results (i.e. height of the bubbles) if you placed the liver test tube and hydrogen peroxide test tube in boiling water for three minutes before combining them. Explain why this change in the rate of reaction would occur based on the changes that occur in enzymes at extremely high temperatures. You must use the terms “shape” and “active site” in your response.

\_\_\_\_\_/4

**Total: \_\_\_\_\_/9**